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# EAVE CONSTRUCTION FOR LARGE CANOPIES

## FIELD OF THE INVENTION

This invention relates generally to large canopies such as the type that provides protection and shade for vehicles in automobile lots and other large areas that require a protective cover. More particularly, the invention is directed to an eave construction that prevents undue buildup of snow and other loads on the canopy cover.

## BACKGROUND OF THE INVENTION

U.S. Pat. No. 5,597,005 to Thomas discloses a canopy structure that is intended for use to cover parking lots, automotive dealer lots, and other large areas in order to provide protection from hail and other inclement weather conditions, as well as to serve as a sun shade. The canopy is constructed using upright posts which support cables that in turn support a flexible cover. Although this type of canopy functions well for the most part, it is not wholly free of problems under all conditions.

In particular, when the canopy is installed in an area that is subject to heavy snowfall, the snow can build up unduly on top of the cover. Between the support cables, the cover can sag when ice, snow, and other loads are applied to it. Because the eaves are held in a substantially rigid condition by taut cables that extend along the eaves, the cover can sag below the level of the eave and create a "cup" condition. Cupped areas are prone to receiving snow and ice to the point where the load becomes so heavy that the structure can fail. This obviously creates a serious problem in geographic areas where heavy snow falls are prevalent.

## SUMMARY OF THE INVENTION

The present invention is directed to a large canopy that is provided with a specially constructed eave structure designed to discharge snow and other materials from the canopy cover before they accumulate unduly and apply loads heavy enough to cause structural damage or other serious problems.

It is the primary object of the invention to provide a canopy eave construction that functions to dump snow and other materials from the canopy before they build up to a point where excessive loads are applied to the cover. Other objects of the invention are to provide an eave construction of the character described which is simple and economical to manufacture and install, which functions in a reliable manner, and which is effective in harsh climates.

The function of discharging snow from the cover is achieved primarily by a unique pipe and rod arrangement that is installed on the eave of the cover, and also by the provision of a special clamp bracket that holds the cover tightly on the support cables to minimize cupping.

In accordance with the invention, hollow pipes are installed in a sleeve which is formed on the edge of the cover that extends along each eave of the canopy structure. The pipes are located at each of the seams which provide channels or passages in the cover that receive parallel support cables extending to the eaves. A rod extends in the sleeve between each pair of pipes. The rods are stiff enough to normally maintain the eave in a straight horizontal configuration. However, if snow or other loads should accumulate on the cover between the support cables, the rods are flexible enough to bow downwardly before the load becomes excessive. Then, the center portion of the rod bows

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downwardly to a low enough position that a chute is formed allowing the snow to slide downwardly off of the cover and past the eave. Once the snow has been discharged, the rods snap back to their normally straight condition extending along the eave.

Another important feature of the invention is the provision of clamp brackets which allow the cover to be pulled tightly so that the tendency for the cover to cup is minimized. The clamp brackets are applied to the sleeve at the eave of the canopy at the locations of the seams. Each bracket has a barrel which extends around the sleeve and closely receives one of the pipes. The brackets can be pulled to pull the cover tautly on the support cables.

Each bracket has a clamp which can be tightened onto the corresponding support cable to maintain the cover in a taut condition. The clamp structure may take the form of U-bolts receiving nuts that may be tightened to clamp the cable tightly between the U-bolts and a plate portion of the bracket. The support cables may have looped ends through which an eave cable can be strung to locate the eave cable outwardly from the sleeve, thereby providing a space wide enough to accommodate the snow or other materials that are discharged past the eave.

Other and further objects of the invention, together with the features of novelty appurtenant thereto, will appear in the course of the following description.

## BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings which form a part of the specification and are to be read in conjunction therewith and in which like reference numerals are used to indicate like parts in the various views:

FIG. 1 is a perspective view of a canopy of the type that may be provided with an improved eave constructed in accordance with the present invention;

FIG. 2 is a fragmentary top plan view on an enlarge scale showing a portion of the eave structure of the canopy of FIG. 1, with one of the rods being inserted into a sleeve formed on the edge of the canopy cover;

FIG. 3 is a fragmentary plan view on an enlarge scale showing detail 3 designated in FIG. 2;

FIG. 4 is a fragmentary perspective view on an enlarge scale showing the eave structure, with portions broken away for purposes of illustration;

FIG. 5 is a fragmentary sectional view taken generally along line 5—5 of FIG. 4 in the direction of the arrows;

FIG. 6 is a fragmentary top plan view showing the clamp bracket depicted in FIG. 4; and

FIG. 7 is an end elevational view of the clamp and related components shown in FIG. 6.

## DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings in more detail and initially to FIG. 1, numeral 10 generally designates a large canopy which is constructed in accordance with the present invention. The canopy 10 is used to cover automotive dealer lots, parking lots, and other relatively large areas that require protection from inclement weather conditions such as hail storms. The canopy 10 may also serve as a sun shade for the protection of vehicles and other objects. The canopy 10 is intended to be a substantially permanent structure rather than one that is intended to be periodically assembled and disassembled such as a circus tent or other similar structure.

The canopy 10 may be constructed for the most part in the manner disclosed in U.S. Pat. No. 5,597,005 to Thomas which is incorporated by reference and to which reference may be made for a more detailed description of the various components of the canopy. The canopy 10 may take a variety of configurations, such as the configuration shown in FIG. 1 which includes a pair of roof structures 14 and 16 connected side to side. The canopy 10 includes gables 18 on its opposite sides and eaves 20 extending between the gable sides of the structure. A pair of ridges 22 are located on the two structures 14 and 16, and a valley 24 is formed between the peaks or ridges 22.

The canopy 10 is supported by a post and cable system which includes upright corner posts 26 located at the four corners of the structure. On the gable sides of the structure, a valley post 28 is located midway between the corner posts 26, and a pair of ridge posts 30 are located between the valley post 28 and each of the corner posts 26. On the eave ends of the structure, a plurality of eave posts 26 are spaced apart from one another between the corner posts 26. A plurality of intermediate valley posts (not shown) are spaced apart along the valley 24 between the two valley posts 28. Similarly, a plurality of intermediate ridge posts 30 are spaced apart along each of the ridges 22 between the two ridge posts 30 provided for each ridge.

The framing for the canopy 10 includes a plurality of framing cables (not shown) which are interconnected with the various posts and with one another, as more specifically disclosed in U.S. Pat. No. 5,597,005. Also included are cables which extend along the ridges 22, along the valleys 24, and along the lower edges of the gable sides of the canopy structure.

A plurality of cover support cables 34 extend generally parallel to one another between the opposite eaves 20, with the support cables 34 extending over the ridges 22 and the valley 24. Each support cable 34 has its opposite ends located adjacent to the two eaves 20.

The support cables 34 provide support for a flexible cover which is generally identified by numeral 36. With additional reference to FIGS. 2-4, the cover 36 is constructed by connecting a plurality of flexible strips or panels 38. The panels 38 are connected together edge to edge at seams 40 which are formed at the panel junctions. As described in U.S. Pat. No. 5,597,005, the seams 40 are formed by looping the edges of adjacent panels 38 together and stitching the looped portions at 42 to form a channel or passage 44 along each of the seams 40. Each of the passages 44 receives one of the cover support cables 34 so that the cover 36 is supported on the cables 34. The end of each passage 44 adjacent to one of the eaves is open so that the corresponding cable 34 extends out through the end of the passage, as best shown in FIG. 4.

The cover 36 may be constructed of any suitable material such as a fabric formed from high density polyethylene. By way of example, the fabric panels 38 may be approximately nine feet wide each so that the adjacent support cables 34 are spaced about nine feet apart. The panels 38 extend in a taut condition between the support cables 34.

As shown particularly in FIG. 4, the eave edges of the fabric panels 38 are formed in a loop to provide a continuous sleeve 46 extending along each eave of the cover 36. Stitching 48 secures each of the looped edges in the form of the sleeve 46.

A rigid pipe 50 which is hollow and open at both ends is installed in each sleeve 46 adjacent to the location of each seam 40. By way of example, each pipe 50 may be approxi-

mately one foot long with its center located at the center of the corresponding seam 40. The eave structure of the canopy includes a plurality of elongated metal rods 52. One of the rods 52 extends between each adjacent pair of the pipes 50. The rods 52 are located within sleeve 46 and extend at their opposite ends into the open end of the pipes 50. By way of example, each rod may be approximately nine feet long with approximately six inches of each end portion of the rod received in the pipes 50. As shown somewhat diagrammatically in FIG. 4, each rod 52 is bent near its center to provide a generally U-shaped bend 54 which may be stitched at 56 to the cover 36. This arrangement maintains each of the rods 52 generally centered relative to the width of the adjacent fabric panel 38 so that neither end of the rod slides completely out of pipe 50. However, the rods 52 are received in pipes 50 loosely so that they can slide inwardly and outwardly.

The rods 52 are preferably constructed of metal and are relatively stiff. The rods are normally arranged with their ends adjacent to each other. Each rod normally extends in a relatively straight condition to provide each eave 20 with a substantially horizontal structure that maintains the eave 20 in a relatively straight and horizontal condition. However, the rods 52 are flexible enough that they can flex or bow downwardly when heavy loads are applied to the canopy, as will be explained more fully. By way of example, each of the pipes 50 may have an outside diameter of approximately  $\frac{3}{4}$  inch, while the rods may each be  $\frac{1}{4}$  inch in diameter.

With particular reference to FIG. 2, the sleeve 46 may be provided with a slit 58 near each of the seams 40. The slits 58 allow the pipes 50 to be inserted into the sleeve 46 in the field, and the slits also allow the rods 52 to be inserted into the sleeve and also into the pipes 50. Preferably, each of the slits 58 is stitched closed in the field after the pipes and rods have been installed.

A plurality of rigid brackets 60 are provided in order to tautly secure the fabric panels 38. Each bracket 60 may be constructed by connecting two identical halves together, with one of the parts inverted relative to the other. Each bracket 60 includes a discontinuous barrel 62 which is open at the center. A substantially flat bracket plate 64 extends from the barrel 62 of each bracket. As best shown in FIG. 5, each of the barrels 62 is generally cylindrical but is provided with a discontinuity or gap 66 allowing it to be fitted onto the sleeve 46. One of the brackets 60 is provided at each of the seams 40, and the brackets are applied to the sleeve 46 such that the pipes 50 are thereafter closely received within the barrels 62.

The plates 64 are located such that the end portion of the corresponding support cable 34 extends along the top surface of plate 64. The plates 64 of the two halves of each bracket are provided with aligned sets of holes allowing a pair of U-bolts 68 to be extended through the holes. The U-bolts 68 are applied to the cable 34 such that the cable is received between the bight portions of the U-bolts and the bracket plate 64. Nuts 70 may be applied to the ends of the U-bolts and tightened against the underside of plate 64 in order to securely clamp the cable 34 to the brackets 60, as well as to secure the halves of the brackets together.

The brackets 60 may be applied to the eave portion of the canopy and then pulled outwardly, either by hand or with a suitable tool in order to pull the cover 36 along cables 34 until the cover is in a suitably taut condition. Then, the nuts 70 are tightened to clamp the brackets 60 and cable 34 together, thereby assuring that the cover is maintained in a taut condition.